THE EFFECTS OF ANXIETY ON PERFORMANCE IN SOCCER AND CRICKET

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Victory
Belongs
to the most
Persevering

(Napoleon)

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ABSTRACT

This study was designed to investigate the effects that anxiety has on cricket and soccer performance and to determine if any such effects would vary according to the attentional demands of the sport. The Sport Competition Anxiety Test (Martens, 1977) was administered to subjects to assess their trait anxiety levels, and a proportion of these subjects were involved in field and experimental research. The field research involved measuring actual performance in the two sports of cricket and soccer, while the experiment consisted of golf putting under high and low anxiety conditions. The field research produced contrasting results as low trait anxiety soccer players performed significantly better than medium and high trait anxiety players, while for cricket, medium and high trait anxiety cricketers performed better than low trait anxiety cricketers. In the golf putting experiment medium and high trait anxiety individuals improved in putting performance in the high anxiety condition compared to the low anxiety condition. It was concluded that the contrasting attentional demands of the sports and the effects that anxiety has on attentional focus are areas which need further investigation if a full understanding of anxiety and its effects on performance are to be achieved. The implications of the results for coaches and players are discussed.

CHAPTER ONE: INTRODUCTION

For both practitioners and researchers of sport, the effects of anxiety on performance has long been a topic of great concern. Anxiety is an integral part of competitive sport and individuals and teams need to understand what anxiety is and the effects it can have if optimal performance is to be achieved.

The Anxiety/Performance relationship is far more complex than many believe and a variety of mediating factors are important in influencing the effect. One mediating factor which has not received much research is attention. Sports have differing attentional demands ranging from narrow to broad. Narrow attention is focusing on a limited range of cues, whereas broad attention takes in a wide range of cues. One of the commonly reported effects of anxiety is its effect on the narrowing of attention.

Despite the empirical attention that anxiety has received in the literature, very few studies in the sport literature have attempted to determine whether the effect that anxiety has on performance varies according to the attentional demands of the sport involved. It is the purpose of this study to investigate this proposition.

This thesis begins with a review of the literature on anxiety, attention and motor performance. It then outlines the rationale for the present study and explains the procedure and method employed. Results are then presented and subsequently examined. Finally implications for sport coaches and players are discussed.

CHAPTER TWO: LITERATURE REVIEW

There is an abundance of research into the area of anxiety and performance in the literature on Sports Psychology. However, it is only in the last ten years that research linking the concepts of anxiety and attention to performance has begun to proliferate. The review which follows outlines research from within the sports psychology literature. Firstly it looks at research involving the concept of anxiety itself, then separately investigates anxiety and attention and their respective influences on performance and then links the two concepts and considers their combined effects on performance. Finally the rationale of the thesis is presented along with the hypotheses to be investigated.

2.1. What is Anxiety?

Anxiety attacks comprising sweaty hands, a pounding heart, queasy stomach, jelly knees and much emotional worry happen at some time or another to most people who are anticipating the performance of some activity or task. Increased anxiety implies psychological or cognitive reactions as well as physiological responses. Both the conceptualization and measurement of anxiety have been helped greatly by Spielberger's (1966) division of anxiety into two major types; state anxiety and trait anxiety.

Spielberger's state anxiety refers to an existing or immediate emotional state characterized by apprehension and tension. In Spielberger's (1966) words:

> "anxiety states are characterized by subjective consciously perceived feelings of apprehension and tension, accompanied by or associated with activation or arousal of the autonomic nervous system."

The state of anxiety (A- state) or reactive anxiety arises as the reaction of a person to varied and most often socio-psychological stress factors, for instance, the expectation of a negative evaluation or aggressive reaction, the perception of an unfavorable attitude toward one's self or a threat to one's self esteem or prestige.

Spielberger's trait anxiety is a predisposition to perceive certain situations as threatening and to respond to these situations with varying levels of state anxiety. Trait anxiety (A - trait) is

> "a motive or acquired behavioural disposition that predisposes an individual to perceive a wide range of objectively non-dangerous circumstances as threatening and to respond to these with state anxiety reactions disproportionate in intensity to the magnitude of the objective danger." (Spielberger, 1966)

Persons high in trait anxiety either perceive more situations as threatening or respond to threatening situations with more intense levels of state anxiety than do those low in trait anxiety.

Therefore, state anxiety (A - state) denotes an individual's situational reaction to some perceived threat, while trait anxiety (A - trait) indicates a somewhat stable characteristic of anxiety that is exhibited across many situations.

These two types of anxiety form the basis for Spielberger's (1966) State-Trait theory of anxiety. In this, he assumes that the degree of anxiety experienced is interactively determined by the individual's susceptibility to

anxiety and by the amount of stress in the situation. A vast amount of research has investigated this very issue, including Martens and Gill (1976), Martens and Simon (1976), Martens (1977), Scanlan and Passer (1978), Gerson and Deshaies (1978), Weinberg and Ragan (1978), Poteet and Weinberg (1980), Weinberg and Genuchi (1980), Sanstroem and Bernardo (1982), Huband and Mckelvie (1982).

They have all indicated consistently that high A - trait individuals manifest greater A - state than do low A - trait individuals in anxiety producing situations. Weinberg and Genuchi (1980), for example, looked at 30 golfers of low, medium and high trait anxiety. Subjects' state anxiety levels were recorded during a practice non-competitive round and on the first and last days of a competition. State anxiety results indicated a significant trait anxiety main effect with low trait anxiety subjects displaying lower state anxiety than did moderate or high subjects.

As a result of the volume of anxiety research in sport a third dimension to anxiety has been added, that being competitive anxiety (Martens, 1977). Competitive anxiety is a situation specific modification of the A - trait, A - state constructs, but remains based on Spielberger's (1966) Trait-State theory of anxiety. Competitive anxiety was developed from research pointing out that anxiety should not be studied as a unitary general phenomenon. Instead Mandler and Sarason (1952) and Sarason, Davidson, Lighthall, Waite and Ruebush (1960) claim that anxiety is a learned response to situations. In other words, one person may become quite anxious in certain situations while not anxious in others. Thus a better prediction of behaviour can be made when more knowledge of the specific situation and how persons tend to respond to these types of situations is available.

Competitive state anxiety is the sport specific counterpart of the motive to avoid failure, or the tendency to become anxious and worried

about failure in sport competition. Sports competition creates some anxiety in nearly all participants. The primary situational source of anxiety in competition is the threat of evaluation. Sports people want to be successful and worry about performing poorly. Competitive trait anxiety is a personality disposition defined as the tendency to perceive competitive situations as threatening and to respond to these situations with feelings of apprehension or tension (Martens, 1977). Consistent with Spielberger's (1966) theory, high competitive trait anxiety subjects manifest higher levels of competitive state anxiety in competitive situations.

2.2. Anxiety and Performance

Among the most vital problems which sport psychologists face is the effect of anxiety on motor performance. Two theories have been suggested to explain the specific influence of anxiety of various types of performance: drive theory and the inverted U theory.

Drive Theory

According to drive theory, the basic relationship between anxiety and performance is expressed as $P = f(H \times D)$. Performance (P) is a function of habit (H) times drive (D). Within the model created by Hull (1943) and modified by Spence (1956) drive is essentially the same as anxiety. The other main component of drive theory, habit, refers to learned responses or behaviours.

Drive theory suggested that as drive (anxiety) increased the dominant response would be emitted (Duffy, 1957). Thus during early practice or

learning, since there is a higher probability that the performance will be incorrect, this dominant incorrect response will be emitted, while during performance of well learned skills, the dominant response will generally be the correct response. This principle implies that increased drive or anxiety facilitates performance of well learned skills but hampers learning or acquisition of new skills. Essentially then drive theory postulates a linear relationship between anxiety and performance.

However, the drive theory lacks supporting evidence. Martens (1971) in a summary of anxiety research did not see drive theory as being useful for anxiety research. He gave two reasons. Firstly results fail to find any consistent findings and secondly it is not possible to adequately test the theory until the habit hierarchy of various motor tasks is understood. This second problem arises because it is difficult if not impossible to establish habit hierarchies for motor responses. The structure of an individual's habit hierarchy is a function of his/her past experience on the task. For each motor task then, and within each group of people the hierarchy will be a variable. According to Martens (1971) when interpreting the results of each experiment a decision had to be made regarding the habit strength of the correct and incorrect responses in determining if the study supported or refuted the theory. This decision was made by categorizing habit hierarchies into such vague classifications as learning and performance.

To exemplify the interpretation difficulties consider a study conducted by Baker (1961). He found that high anxiety subjects performed better than low anxiety subjects in the absence of stress and the opposite results in the presence of a stressor. The task in this experiment was matching foot patterns while walking on a treadmill. Martens (1971) rightly asks the question of whether matching foot patterns was a well learned response for the subjects or one that needed to be acquired. Another difficulty in determining the habit hierarchy of a motor response is that it changes as a

function of practice. Most of the studies reviewed used repeated trials as part of the experimental procedure. Therefore it is possible that during initial trials the incorrect responses were dominant and after some unknown point the correct responses became dominant.

Not all studies have followed the experimental approach in testing drive theory however. Hammer (1967) compared trait anxiety scores of college athletes (football players and wrestlers) with non-athletes. He also had coaches rate the performance of the athletes and compared trait anxiety scores among individuals classified as high and low achievers. Athletes were found to have no significant difference in trait anxiety scores compared to non-athletes and no difference was found between low and high achievers.

In a similar study Hammer (1968) determined if individuals classified as achievers, participants, or non-participants in ten different sports differed significantly in anxiety. He was attempting to discover if various levels of anxiety can predict performance. He expected to find that achievers were more anxious than participants who were more anxious than non-participants. However, again no significant differences were found.

Because of inconsistent results and limitations in determining habit hierarchies it has been suggested that drive theory is operationally non-functional for complex motor behaviour (Martens, 1971).

Inverted U Theory

The inverted U theory, originally postulated by Yerkes and Dodson (1908), proposes that performance is optimal at a moderate level of anxiety and that performance progressively declines as anxiety increases or decreases from a moderate level. The inverted U theory assumes that individuals

need some anxiety to perform at their best, athletes who are too relaxed or apathetic give sub-par performances. With too much anxiety however, sport performers may be over-anxious, tense and prone to errors. The inverted U theory has generated enthusiastic support in the motor behaviour area for two major reasons; there is considerable experimental evidence in support of it, and there is a great deal of intuitive appeal for the theory. This intuitive appeal comes from coaches and athletes who use commonly such terms as "not up for the game", "psyched up", and "psyched out" (Sonstroem & Bernardo, 1982).

There is considerable empirical evidence to support the inverted U theory. Martens and Landers (1970) tested the theory in a motor performance situation. Junior high school males performed a tracking task in a controlled experimental setting under low, moderate or high anxiety conditions. The anxiety levels were manipulated by varying the emphasis on performance scores from a relaxed low anxiety setting in which no emphasis was placed on scores to an elaborate high anxiety condition. Subjects were hooked up to a bogus shock machine with instructions indicating that low scores would result in shocks. The three anxiety conditions yielded three levels of anxiety as confirmed with both physiological and self-report measures. Performance scores formed an inverted U pattern with the best performance scores being in the moderate anxiety condition.

Klavora (1977) utilized a repeated measures design with 95 boys representing 14 high school basketball teams. He controlled for difference in playing ability by asking coaches after each game to evaluate a player in terms of whether he had played below, close to, or well above his own usual performance ability. Across 8 to 14 games for each player Klavora found that outstanding performances were associated with moderate levels of pre-competitive state anxiety and average performances were associated

with means either smaller or larger than the mean A - state score for the outstanding category. Poor performances contained the smallest and largest A - state means in the five derived categories.

Sonstroem and Bernardo (1982) confirmed the inverted U theory in a field study with female university basketball players. They compared each athlete's lowest, median and highest pre-game state anxiety scores with the athletes' composite performance score for the three games. They found an inverted U relationship in that the best performances were associated with moderate state anxiety levels and high and low state anxiety scores were associated with the poorest performances.

Other investigators have reported similar findings. Wood and Kokanson (1965) observed a similar patterning of performance when anxiety had been experimentally produced by varying muscle tension. Fenz and Epstein (1969) reported a similar relationship between physiological and self-report measures of anxiety and jumping accuracy of sport parachutists. Babin (1966), Levitt (1972) and Levitt and Gutin (1971) also found reaction time performance curves resembling inverted U relationships in that performance was best at moderate levels of anxiety.

There have been some experiments reported that do not show inverted U relationships (Matarazzo, 1956; Murphy, 1966; Pinneo, 1961). Pinneo for example investigated the effects of induced muscle tension on performance of a tracking task. He had subjects in a muscle tension induction system. A modified hand dynamometer was used for inducing tension. Subjects had to maintain a level of muscle tension while performing a tracking task using a foot pedal. There were five tension conditions given once to each subject in a random order. A condition of no tension was also randomly presented with the tension conditions. Physiological measures were taken to measure the anxiety levels. They were highly consistent in showing regular and continuous rises as a

function of increments in tension induced in the right arm during tracking. Performance on the tracking task was affected by induced muscle tension but not in the expected direction. It was assumed that subjects were relatively relaxed at the lower levels of muscle tension and it was expected that performance would be enhanced with induced muscle tension. However, the results showed that there was a significant decrement in performance, a finding which goes against the inverted U theory.

Researchers have also begun to concentrate on variables which might modify the predicted anxiety performance relationship. The inverted U relationship between anxiety and performance is much more complex than the general pattern suggests and the following mediating factors have been suggested to affect the shape of this relationship.

Trait Anxiety.

Trait-State anxiety theory (Spielberger, 1966) predicts that persons who are high in trait anxiety respond with greater amounts of anxiety to evaluative situations than do persons who are low in trait anxiety. Because high and low trait anxiety individuals respond with different amounts of anxiety to identical situations these different levels should lead the two groups to perform differently in similar settings. Specifically the theory predicts that low trait anxiety subjects will perform better after a stressful experience than after a non-stressful experience whilst high trait anxious subjects would perform better after a non-stressful experience than after one in which they were stressed.

The reasoning behind this is simple, the low trait anxiety subjects need some stimulation to reach a more aroused state. The high trait anxiety subjects however are already in a more highly aroused state and further stress may put them over the limit. They need to be relaxed and reduce stress. Results with sports subjects generally support this theory (Lucas,

1953; Katchmar, Ross & Andrews, 1958; Sarason, 1957, 1961, 1968; Weiner, 1966; Hodges & Spielberger, 1969; Weiner & Schneider, 1971; Weinberg & Hunt, 1976; Wankle, 1977; Weinberg & Ragan, 1978; Weinberg, 1978, 1979).

The basic research designs employed by these investigators have been similar. Firstly groups of low and high trait anxious subjects are selected. Subjects then perform a designated task. Half of the subjects within each anxiety group are then given feedback indicating success on the task while the other half are given feedback indicating that they have failed. All subjects then perform the task again and the pre-feedback and post-feedback scores for each anxiety group are compared. Results generally indicate that the performance of low trait anxiety subjects decreases after non-stressful success experience, but increases after stressful failure experiences. Conversely, high trait anxiety subjects exhibit relative increases in performance after non-stressful experiences, but display decreases in performance after stressful experiences.

One example of this line of research illustrates the general form that has been taken. Weinberg and Ragan (1978) tested the effect of trait anxiety on performance by using three levels of trait anxiety and of psychological stress. Low, medium and high trait anxiety subjects had to throw a tennis ball at a target comprising three concentric circles. Subjects were given motivating and ego-involving instructions which stressed that the task would measure each persons' general athletic ability and would be an excellent predictor of success in numerous sports involving throwing motions. After completing 10 throws, feedback was provided concerning the quality of the subject's performance in relation to norms established for college males. Three different feedback levels were possible. High stress indicated that the subject had only done better than 10% of the college students tested. Medium stress indicated 40%, while low stress indicated

that the subjects had done better than 70% of the college students tested. After this the subjects were asked to make a further 10 throws. The performance results produced an inverted U curve for the three levels of stress with subjects in the moderate stress condition displaying the highest performance. Most importantly, however, was the significant trait anxiety x stress interaction which indicated that high trait anxious subjects performed best in the low stress condition while low trait anxious subjects performed best in the high stress condition.

Competence and Past Performance

Successful athletes and individuals with high levels of self confidence seem to be able to deal with stress and anxiety in a manner which allows them to optimize performance over a wider range of situations. Mahoney and Avener (1977) found in studies dealing with Olympic gymnastic qualifiers and non-qualifiers that the more successful athletes were able to reduce their anxiety levels in the crucial moments just prior to competition by focusing their thoughts on the task at hand. The less successful failed to do this. Similar results have been found with springboard divers (Siebold, 1979) and sky divers (Fenz & Epstein, 1960). This suggests that is may not be the absolute level of anxiety but the ability of the athletes to control their anxiety which governs eventual sport performance.

Achievement Motivation

Another possible mediating factor of the inverted U relationship is achievement motivation. Achievement motivation is broken up into two tendencies. The tendency to achieve success, and the tendency to avoid failure (Atkinson & Feather, 1974; Mehrabian & Bank, 1975). Individuals with high levels of achievement motivation have stronger tendencies to achieve success than to avoid failure. They do not generally perceive the

evaluative information from competition as threatening. These individuals prefer achievement situations and attempt to maximize the comparative appraisal information. Conversely low need for achievement individuals prefer to shy away from evaluative competition as they perceive greater threat (Scanlan & Ragan, 1978).

Task Difficulty or Complexity

Perhaps the most talked about mediating variable in this context is task difficulty or complexity. There has been a great deal of conjecture concerning the mediating effects of specific task variables and their effect on sport performance. Oxendine (1970) made the somewhat over-simplified generalization that high levels of anxiety may facilitate tasks requiring strength and speed but negatively affect those requiring balance and precision. Oxendine tried to rank sports motor skills in terms of a continuum of required precision and accuracy versus strength and speed, and therefore be able to predict what level of anxiety would produce maximum performance (see Table 1).

Table 1. Optimal Anxiety Levels Across Various Sports (Oxendine, 1970)

Anxiety Level	Sport/Skill Most Optimally Performed
5 (High)	Weight lifting
4	Track and field, Swimming, Judo
3	Boxing, Gymnastics, Basketball
2	Baseball, pitching, batting, Fencing
1 (low)	Archery, Bowling, Putting in golf

This classification system, however, fails to take into account the perceptual and attentional demands of the sports. Oxendine's generalizations are not specific enough and more precise descriptions of sports including attentional requirements will permit better prediction of optimal anxiety levels (Landers, 1979).

The influence of attention on sports performance and its link with anxiety now becomes the focus of this literature review.

2.3. Attention and Performance

It is easy to recognise the central role of cognitive skills in sport. In fact it is difficult to conceive of any situation in sport in which an individual's ability to pay attention and concentrate on certain things while ignoring others is not critical to effective performance.

The idea that attention, the ability to direct our senses and thought processes to particular objects, is important to performance is not new. However, we are only now beginning to understand the attentional demands for particular situations. This is because the physical demands of sport are easily identified whereas the mental or cognitive demands are less obvious.

Nideffer (1976) did much to bring attentional style to the fore. He proposed that attentional style exists along two dimensions: width and direction. Width of attention can be thought of in terms of how much information an individual must attend to, within a given time frame. Width ranges from narrow to broad. Narrow attention is focusing on a limited range of cues. Whereas a broad focus takes in a wide range of cues.

A great many sports require the athlete to shift rapidly from a broad focus of attention to a narrow focus. For example, it is possible to think of

the broad focus of attention as serving primarily an assessment function. It is this type of attentional focus the athlete uses to determine a course of action. As a decision is reached attention is typically narrowed to allow for the execution of a response like passing the ball.

The direction of attention refers to whether an athlete is attending to his/her own thoughts and/or feelings, internal cues, or to things going on around him/her, external cues.

Just as an individual's attention can be defined in terms of width and direction, the environmental situation will also demand a certain type of attention. Hence the ability to be able to define the attentional demands of a particular situation is very important. If the individual's attention corresponds to the environmental demands they will function effectively, if not they will make mistakes.

Nideffer (1976) has classified sports in relation to their attentional demands. Consider the attentional demands placed on a soccer player. Soccer players need to have some sense of what is happening on the entire field, especially if they do not have the ball. The primary attentional demand in soccer is for a broad external focus of attention (Nideffer, 1976). Ultimately the focus of attention must narrow as the athlete acts to shoot or pass but in general play the player must have a broad view of the entire field. A soccer player cannot afford to be dominated by a narrow focus of attention. The phrase of having "tunnel vision" sums up well the problem a soccer player has if a broad view of the entire field is not maintained.

Contrast the attentional demands placed on soccer players with the attentional demands placed on a golfer or on a batter in baseball, softball or cricket. Here the demand is for a narrow external focus of attention (Nideffer, 1976). Batting in baseball is a task that is frequently cited in the sport science literature as carrying with it one predominant narrow

attentional demand (Nideffer, 1976, 1978, 1981; Van Schoyck & Grasha, 1981; Albrecht & Feltz, 1987).

If one considers the actual fine coordination and timing that is required to strike a ball traveling at high speeds then it becomes very apparent that the ability to focus attention could have a large influence on performance. Magil (1985), for example, estimates that a baseball thrown at 90 miles per hour takes only 0.4 seconds from the time the ball leaves the pitcher's hand until it crosses the plate. After allowing for necessary movement and reaction time batters are realistically left with probably only 0.1 to 0.15 seconds to decide whether or not to swing and if so which swing to use. Under such conditions even the slightest error in attentional focus can make the difference between success and failure. For a batter in baseball or cricket to let their attention broaden would be disastrous. They would become over-loaded with irrelevant stimuli and concentration would be destroyed.

There have been very few empirical studies concerned with attention and performance in sport. Nettleton (1986) tried to investigate this area by looking at flexibility of attention on a task involving anticipation of light illumination on two runways. Nettleton described flexibility as similar to Nideffer's broad focus of attention. On each trial the stimulus lights on each runway were illuminated in succession towards the subjects at a pre-set velocity manipulated by the experimenter. The subjects had to push two buttons in time with the two runways as the last light in each runway was illuminated. Nettleton investigated the flexibility of attention of team game players from the sports of soccer, hockey and Australian Rules Football. He looked at good performers compared with elite performers in these sports. On the task, elite performers made fewer errors. This suggests tentative support for the superiority of attentional flexibility of elite fast ball game performers.

R. M. Nideffer (1976) developed a scale to measure attentional style. The Test of Attentional and Interpersonal Style (TAIS) was developed to provide an indication of the individual's tendency to adapt either an appropriate or inappropriate attentional focus. The TAIS contains six scales designed to measure attentional abilities. The majority of the evidence supporting the predictive validity of Nideffer's attentional scales has been correlational in nature. For example, Nideffer (1976) compared a coach's performance ratings of competitive male swimmers to the swimmers' attentional scale scores. Statistically significant correlations suggested the following relationships. Swimmers scoring high on one of the TAIS scales measuring "under-inclusion" (focus is too narrow when it should be broad) were described by the coach as: choking under pressure, after making early performance errors and becoming worried about one particular thing and being unable to think about anything else. Swimmers who were inconsistent in their performance also tended to be over-loaded with external and internal stimuli and unable to effectively narrow attention. Consistent performance was characteristic of swimmers who were able to effectively narrow their attention.

However, in more comprehensive studies by Van Shoyck and Grasha (1981) and Albrecht and Feltz (1987) the reliability and validity of the TAIS was questioned. In these studies the researchers developed sport specific attentional scales based on the original TAIS. In comparison with the TAIS their scales produced better results. Albrecht and Feltz (1987), for example, compared their baseball specific attentional scale with the original TAIS. They found that baseball batting over a season was positively related to the baseball attentional sub-scales assessing effective narrow attentional deployment and negatively related to all sub-scales assessing ineffective attention. These relationships were not found with the general TAIS. This difference may result from the ability of the task-specific instrument to

assess the degree to which the subject is able to effectively direct his or her attention toward task appropriate cues, as opposed to any cue - relevant or irrelevant - present in the environment (Albrecht & Feltz, 1987).

For example, while the ability to direct attention in a narrow-external manner may generally be necessary to hit a baseball, it is specifically the ability to direct attention in a narrow-external manner toward task-relevant environmental cues (i.e., the ball) that must be assessed. An equal ability to narrow attention in regard to non-relevant stimuli would actually result in a performance decrement.

The studies by Van Schoyck and Grasha (1981) and Albrecht and Feltz (1987) also found that Nideffer's direction of attention scales were not supported. Instead the width of attention were the more important scales. This finding is backed up by Landers (1982) in a summary of attentional research. Landers concluded that these attentional scales appear to be particularly useful if one is interested in the breadth of attention from broad to narrow, or in detecting which athletes may lack the ability to concentrate because they are over-loaded and reduce attention too much. However, they do not seem to be useful in predicting the direction of attention. At present then firm conclusions can only be made in relation to the width dimension and hence this area is one focus for the present research.

The relationship between attention and performance in sport then is generally predictable. However, there is also a great deal of research data showing a relationship between the ability to direct and control attentional processes and increasing pressure or anxiety. Of particular interest is the general finding in the literature that as anxiety increases attention becomes less flexible and then begins to narrow. Therefore ability to attend or concentrate in the most task relevant way is affected by alterations on levels of anxiety. Thus an understanding of the relationship between attention, anxiety and performance is needed.

2.4. Attention, Anxiety and Performance

Research on the area of anxiety, attention and performance has stemmed largely from the work of Easterbrook (1959). Easterbrook suggested essentially that the effect of anxiety on attention is to narrow and focus the attentional field by systematically reducing the range of cue utilization. The range of cue utilization is defined as,

> "the total number of environmental cues in any situation that an organism observes, maintains an orientation towards, responds to, or associates with a response" (Easterbrook, 1959)

Easterbrook postulated that the narrowing and focusing of the attentional field under anxiety involves not only diminished utilization of peripheral cues but also the maintained, if not improved, use of central immediately relevant cues. Easterbrook then went on on to say that anxiety acts consistently to reduce the range of cues that an organism uses and that the reduction in range of cue utilization influences action in ways that are either organizing or disorganizing, depending on the behaviour concerned.

This is perhaps the most important area of discussion. According to Easterbrook anxiety is neither consistently facilitating nor consistently disrupting. Whether one effect or the other is observed depends upon the level of anxiety and the characteristics of the task. For some tasks a reduction in cue utilization may improve performance. For instance, a reduction in the range of cue use as a result of high anxiety will impair performance on a complex multi-cue task on the assumption that some task relevant cues will be omitted from attention. Conversely such a reduction of cue use will lead to improved performance on a simple task requiring a

few selected cues. This is based on the assumption that task irrelevant cues and distractions are omitted from attention.

> "Irrelevant cues are excluded and anxiety is then said to be organizing or motivating. In other tasks proficiency demands the use of a wider range of cues and anxiety is disorganizing or emotional. There seems to be an optimal range of cue utilization and hence an optimal level of anxiety for each task." (Easterbrook, 1959)

The research conducted in this area generally involves Dual-Task studies. The common denominator in these studies is that two tasks compete for the subject's attention. In general a central task is more demanding of the subject's attention than the peripheral task. This paradigm assumes that attention has a capacity limit. If a central task requires large amounts of the total capacity, only a minimal amount of attention can be allocated to a peripheral task.

Wachtel (1968) had subjects perform a continuous tracking task which occupied the central attentional field while also having to pay attention to peripheral lights. The subjects had to react to the lights while still doing the tracking task. The subjects were placed in stress and non-stress situations and the results were compatible with the hypothesis that anxiety reduces the reponsiveness to peripheral stimuli. The subjects who were threatened with electric shock had significantly longer reaction times to the peripheral lights than did subjects presented with exactly the same task who were not threatened with shock. The groups did not differ on the central tracking task. Thus anxiety did not generally impair all performance but only performance on peripheral aspects of the task.

Bahrick, Fitts and Rankin (1952) produced similar results. In a replication of Wachtel's (1968) study, high anxiety subjects did better than

low anxiety subjects on a continuous tracking task, but more poorly in reporting the occurrence of occasional stimuli in the periphery. A large number of studies have found that perceptual narrowing accompanies anxiety (Callaway & Thompson, 1953; Bursill, 1958; Kabrick & Dujek, 1970; Berkum, 1964; Callaway, 1959; McNamara & Fisch, 1964).

Agnew and Agnew (1963) tested the hypothesis in a slightly different way. In this study subjects completed two separate tasks, the Porteus Maze Test and the Stroop Test. The Porteus Maze test involved the subjects completing 14 mazes. Each subject was instructed at the beginning to find a way out of the maze as quickly as possible, not to bump into any lines, not to go into blind alleys, and not to lift the pencil from the paper. Time taken for each maze was recorded. It was assumed that this was a broad-attention task which requires the simultaneous use of a variety of spatial and temporal cues.

The Stroop Test consists of three sets of cards. On the first card the names of four colours (red, blue, green, yellow) are printed 100 times in random order while on the second card dots are painted in the same four colours and arranged 100 times in random order. The third card contains 100 examples of the four colours super-imposed on the printed names of the colours, the actual colour being super-imposed on the name of a different colour. For example, the printed word "red" may be tinted yellow or blue. For Card I the subjects were required to read the names of the colours as quickly as possible. On Card II the subjects were required to report the colour of each of the dots as quickly as possible. For Card III the subject had to name the colours as quickly as possible ignoring the printed word on which the colour was super-imposed.

It was assumed that performance on Card III of the Stroop would benefit from narrowed attention by acting to exclude the printed name of the colour. It was also assumed that performance on Card II would similarly

benefit by the exclusion of task irrelevant cues. It was predicted that high drive (anxiety) conditions would impair performance on the Porteus Maze test but facilitate performance on the Stroop Colour Test. Drive (anxiety) in this study was manipulated through the threat of electric shock. A sample electric shock of 125 volts was given for a duration of 30 milliseconds through electrodes attached to the subject's left hand. Then it was stated that the shock would be stronger and would be repeated if the subjects level of performance fell below the average for his/her group. The low drive (anxiety) condition was produced by explaining to each subject that a new use for these tests was sought, and that they were seeking further information as regards the tests. The results of this study support Easterbrook's hypothesis. Performance on the Maze Test was significantly impaired under the high drive while performance on the Stroop Test significantly improved.

However, one obvious question is; how do these studies relate to sport? Very few studies have actually looked at this. For sport performance the significance of the peripheral visual field lies in the fact that it occupies more than 98% of the light sensitive region of the retina, and the loss of peripheral sensitivity can greatly handicap performance in some sport skills by interfering with the capacity of the visual system to process information (Graybiel, Jokl & Trapp, 1955).

In making the application to sporting performance it is important to determine whether the perceptual narrowing effects can generalize to sport settings. The limited research which has been done in this area has generally been positive.

Fenz and Epstein (1969) observed that anxiety in sport parachutists "served a useful function by focusing the individual's attention on the danger area". Similar conclusions were reached by Weltman and Engstrom (1966) in this study of novice scuba divers. Response time to peripheral

light decreased whereas the central task was maintained as depth (and hence anxiety) increased.

In many sports the direction of attentional focus is narrowed on to a primary object or task. In order to optimize performance in these types of sports, coaches maintain that athletes need to be maximally attentive to the relevant features of the task while blocking out the numerous extraneous task irrelevant cues.

Landers, Wang and Courtet (1985) looked at peripheral narrowing among experienced and inexperienced rifle shooters under low and high stress conditions. This study examined Easterbrook's (1959) hypothesis that performance on a primary task would improve or at least be maintained with increased levels of anxiety, while performance on a secondary task would decrease. It was tested by comparing shooters' performance on a primarily important target shooting task and a peripheral auditory and visual task under low and high stress conditions.

The results generally supported Easterbrook's hypothesis. With increased levels of anxiety attention must be diverted from sources of secondary importance so that performance on a primary task is maintained. When the difficulty of the primary task was intensified by increasing the time demands, subjects in the high stress condition took longer to react to the peripheral stimuli than when they performed in the low stress condition. This delayed responding suggests that subjects expended greater effort in focusing their limited attentional capacity on the primary target task. In this case, as anxiety increased, subjects had less spare attentional capacity to allocate to perceptual monitoring of rare events.

An interesting factor was that although subjects were able to maintain performance while shooting in the high stress condition, this was modified somewhat when the temporal order in which the stress conditions were experienced was examined. It was found that those who experienced the

high-low stress order shot significantly better than those receiving the low-high stress order.

These findings support the transfer level of stress explanation as proposed by Willis (1967). It appears that subjects who were subjected to the high stress condition initially increased in anxiety above the baseline which may have helped them achieve the appropriate anxiety attentional set for this task. By contrast subjects beginning with the low stress condition may not have had the optimum anxiety attentional set to begin with.

For the majority of situations in sport most individuals will at least approach the activity with some degree of physiological or cognitive anxiety. As a result of heightened anxiety attentional narrowing occurs accompanied by a loss of sensitivity to environmental cues. Easterbrook's theory predicts that performance under these conditions will depend on the degree of anxiety and the number of relevant and irrelevant cues involved in the task.

2.5. Rationale

By considering the combined effects of anxiety on attention and optimal performance levels it becomes readily apparent that it is important for the coach to know in advance the demands his/her particular sport makes on the participant with respect to attentional variables.

A broad focus of attention is useful in "open skills" that require the individual to be aware of, and able to respond to, a complex rapidly changing environment. This is characteristic of soccer. By contrast a narrow focus of attention is useful in intricate complex "closed skills" such as hitting or batting in baseball or cricket.

Because of the link between anxiety and narrowed attention, anxiety could have a major influence on sport performance. Anxiety could either be facilitating or inhibitory depending on the sport involved and the attentional requirement of the task. Sports demanding narrow attentional focus may tolerate higher levels of anxiety since there are fewer task cues and therefore less chance of task relevant cues being eliminated through the perceptual narrowing process.

The present study was designed to test performance of soccer players and cricketers at varying trait anxiety levels. The research was of a field nature and was aimed to test actual performance in the two sports.

Because cricket batting is a narrow focus task requiring narrow attentional focus it was predicted that batting may be aided by moderate to high levels of anxiety. The anxiety is facilitating because it helps focus on the task relevant cues, while forcing out distractions and irrelevant cues. On the other hand soccer, which has a general need for a broad focus of attention, may be adversely affected by moderate to high levels of anxiety. The anxiety is inhibiting because it forces attention to narrow and this causes the soccer player to be restricted in their ability to view the game.

Soccer and cricket were chosen because of their contrasting attentional demands. Therefore increases in anxiety were expected to have opposite effects for the two sports.

As an extension of this field research an experiment was designed to test golf putting performance in soccer and cricket players under two conditions: one, a practice low anxiety condition; and two, a competition high anxiety condition. Golf putting was chosen because it also involves a narrow focus of attention. It was expected that the increase in anxiety would lead to an increase in putting performance because of the perceptual narrowing accompanying the increased anxiety.

Thus the primary purpose of this study was to investigate the effect that anxiety has on sport performance and to determine if any such effect would vary according to the attentional demands of the sport.

2.6. Hypotheses

Three hypotheses were investigated. All three were derived from research investigating the combined effects of anxiety and attention on sport performance.

Hypothesis 1:

Cricketers with medium to high levels of trait anxiety will perform better over a season of batting compared to those with low levels of trait anxiety.

Hypothesis 2:

Soccer players with low to medium levels of trait anxiety will perform better over a season compared to those with high levels of trait anxiety.

Hypothesis 3:

Both cricketers and soccer players with medium to high trait anxiety will perform better on a putting task in the increased state anxiety condition compared to the low state anxiety condition.

CHAPTER THREE: METHOD

3.1. Subjects

Subjects consisted of 100 cricketers and 100 soccer players. The 100 cricketers were top order batsmen (e.g., first six batsmen) from ten Christchurch senior cricket teams and seven first eleven secondary school teams. The 100 soccer players were from 10 teams. These ten teams comprised one national league team, five Southern Regional league Division one teams, and four Southern Regional league Division two teams.

Of the 200 subjects who agreed to participate, 60 soccer players and 60 cricketers were selected at random to take part in a field study. Thirty soccer players and 30 cricketers were selected at random to take part in an experimental study.

Two subjects had to be withdrawn from the experimental study because they had left the city. As these withdrawals took place before the experimental study began the two subjects were replaced by others from the initial group.

3.2. Design

The design of the present study fell into two distinct sections:

1) Field Research
2) Experimental Research

1) Field Research

The field research was concerned with an analysis of cricket and soccer performance in relation to trait anxiety levels. This gave one independent variable, subject's trait anxiety levels, as measured by the Sport Competition Anxiety Test (Martens, 1977). This yielded three trait anxiety levels, low, medium and high.

Two separate dependent variables were measured:

- cricket batting average over a season

- average soccer performance out of 20 over three games

2) Experimental Research

The experimental research centred on an analysis of putting performance in relation to trait anxiety level and state anxiety level. This gave one between-group variable, Trait Anxiety, which had three levels - low, medium and high - and one within-group variable, state anxiety, which had two levels - practice and competition. Therefore there were two independent variables:

- subjects' Trait anxiety level as measured by SCAT (Martens, 1977)

- subjects' State anxiety level as measured by CSAI (Martens, 1977)

The two dependent variables were:

- practice and competition putting performance scores.

3.3. Measures

Sports Competition Anxiety Test

One hundred male cricketers and one hundred male soccer players were administered the Sport Competition Anxiety Test (SCAT, Martens, 1977). SCAT is a trait anxiety scale designed for measuring a predisposition to respond with varying levels of state anxiety in competitive sports situations. The SCAT was constructed primarily for research purposes to identify subjects varying in competitive trait anxiety. This particular trait anxiety test was used as it is designed specifically to measure competitive trait anxiety rather than general trait anxiety and is therefore more suited to anxiety research in the area of sport. Considerable laboratory and field research has demonstrated that SCAT has high construct validity and is a reliable predictor of state anxiety in competitive situations (Martens, 1977; Martens & Simon, 1976; Wankel, 1977; Scanlan, 1978; Poteet & Weinberg, 1980; Wienberg & Genuchi, 1980; Huband & McKelvie, 1986; Murphy & Woolfolk, 1987).

Cricket Batting Average

The subjects' batting performance was measured by collecting their batting averages for the 1988/89 cricket season, i.e., $\frac{\text{total runs}}{\text{no. of innings}}$ with a minimum of 12 completed two day match innings required. The averages did not take into account not out innings.

Soccer Performance

Soccer performance analysis was done by 10 raters of considerable soccer experience. They were either local Christchurch coaches or national league soccer players. Depending on the position concerned certain guidelines were established for performance appraisal with the help of Terry Conley, a New Zealand technical director of coaching. With these guidelines the raters were asked to judge the players' performances out of 20. The average player performance was achieved by three viewings of the player (See Appendix C for details of the scale).

To establish a consistency check on the raters all 10 raters were asked to rate the same player during a match between Christchurch United and Technical on April 28th. The ten scores were 13, 13, 13, 13, 13, 14, 14, 15, 15, 16. A mean of 13.9 and a standard deviation of 1.100 shows a reasonable consistency among the judges.

Putting Performance

The experimental putting task consisted of putting a golf ball from five different distances, three putts from each distance, giving a total of 15 putts. The distances were 1, 2, 3, 3.5, and 4 metres. The putting was done on carpet at either the subject's house or work-place. The different carpets encountered meant variable conditions but in no case did the carpet cause the ball to dramatically change direction. This type of task has been used previously in anxiety research by Murphy and Woolfolk (1987). Putting a golf ball was selected because it involves find muscle coordination and narrow attentional focus (Nideffer, 1976).

State Anxiety Measure

To check that there was increased State anxiety for the second putting condition. a manipulation check using the short form of the State Trait Anxiety Inventory, The Competitive State Anxiety Inventory (CSAI, Martens, 1979) was employed. According to Gruber and Beauchamp (1979) and Huband and Mckelvie (1986) the CSAI is adequately valid and is suitable for repeatedly measuring state anxiety in a competitive environment.

3.4. General Procedure

The SCAT was administered to each subject before his soccer or cricket practice. The tests were scored using a standard scoring procedure which could give resultant scores varying from 10 (low trait anxiety) to 30 (high trait anxiety). From the 100 cricket subjects those placed into the low trait anxiety group had scores below the 25th percentile which corresponded to a test score of between 10 and 20. The medium trait anxiety group were selected using scores in the 25th to 75th percentile which corresponded to test scores in the range of 21 to 24, while the high trait anxiety group had scores above the 75th percentile, corresponding to a test score of between 25 and 30.

From the 100 soccer subjects two SCAT forms were not returned leaving 98 subjects. Subjects placed into the low trait anxiety group had scores below the 25th percentile, corresponding to a test score of between 10 and 18. The medium trait anxiety group were selected using scores in the 25th to 75th percentile, which corresponded to test scores in the range of 19 to 24, while the high trait anxiety group had scores above the 75th percentile, corresponding to a test score of between 25 and 30.

In the cricket sample there were 35 potential low trait anxiety subjects, 43 potential medium trait anxiety subjects, 43 potential medium trait anxiety subjects, and 22 potential high trait anxiety subjects. In the soccer sample there were 35 potential low trait anxiety subjects, 36 potential medium trait anxiety subjects and 27 potential high trait anxiety subjects.

Twenty subjects from each trait anxiety group were then randomly selected for the field study of both cricket and soccer. Ten subjects from each trait anxiety group were then randomly selected to take part in the experimental study. This gave a total of 120 subjects involved in the field studies and 60 subjects involved in the experimental study.

Sixty cricketers then, of low, medium and high trait anxiety had their batting performance over a season measured in relation to their trait anxiety level. And sixty soccer players of low, medium and high trait anxiety had their playing performance over three games analysed in relation to their trait anxiety level.

The experimental research in this study involved 60 subjects, 10 from each trait anxiety level of the soccer and cricket subjects. Testing for this experiment began on the 8th May and continued through to the 28th July. The experimental task was putting under two conditions of anxiety. Each subject served as his own control as they were tested in both experimental conditions.

All subjects received standard task directions. After setting the putting task subjects were told:

> "You are about to take part in a putting competition between 60 people, 30 soccer players and 30 cricketers. The task of putting has been shown to be good predictor of fine muscle coordination. You are allowed two putts to familiarize yourself with the task. Then 15 putts will be made, three from each distance starting from the shortest and moving out. These 15 putts do not count for the competition but allow feedback as to where you stand in comparison with the other competitors."

As a small incentive a $30 prize was offered for the best aggregate from the final 15 putts. This prize was offered in order to enhance the perception of competitiveness among subjects. This type of monetary prize was used by Murphy and Woolfolk (1987) also to increase competitiveness.

After completing the first 15 putts all subjects then received the same feedback, which involved a poor comparison with the other subjects looked at. They were told:

> "Your performance score was (1 - 15) which in comparison to the others I have so far looked at is not that good and places you in the bottom 50%. To win you will need to improve."

It is in the rare case a subject scored exceeedingly well in the first 15 putts and would contradict the pre-assigned feedback, he was told:

> "Your performance score was (1 - 15) which is high, however, most others have found the task to be just as easy and may have done better. To win you will still need to improve."

The pre-assigned feedback was designed to increase state anxiety. Conditions of failure or ego involvement have generally been reported as

leading to heightened state anxiety (Hodges, 1968; Spence & Spence, 1966; Lundgren & Schwab, 1977).

After the feedback the subjects were asked to again perform the task, with the scores this time counting towards the competition. The CSAI manipulation check was filled out after the practice condition and after the competition condition.

Upon completion of the experiment each subject was told of the manipulation involved and the aims of the study in general.

CHAPTER FOUR: RESULTS

Statistical Analysis

Eight analyses of data were carried out. In order of presentation they are:

1. A one-way analysis of variance was performed to test hypothesis one, i.e., to assess the effect of trait anxiety on cricket batting performance.

2. A one-way analysis of variance was performed to test hypothesis two, i.e., to assess the effect of trait anxiety on soccer performance.

3. *T* -tests were carried out on soccer data to determine which trait anxiety levels contributed to the differences in performance.

4. A two-way analysis of variance was performed to test hypothesis three, i.e., to assess the effect of trait anxiety and state anxiety on practice and competition putting performance.

5. *T* -tests were performed on the putting data to see which trait anxiety levels led to differences in practice and competition putting.

6. *T* -tests were performed on the putting data to investigate the specific differences between the trait anxiety levels and the scores recorded in practice and competition putting.

7. To check that the manipulated anxiety had actually caused an increase in state anxiety *t* -tests were performed to check for differences within each trait anxiety level for increases in state anxiety from practice to competition.

8. The final manipulation check involved assessing the ability of the Sport Competition Anxiety Test to predict state anxiety reactions by subjects. Specifically, that the higher your trait anxiety the higher your state anxiety in competitive situations. A series of *t* -tests were performed to test this.

The one-way analyses of variance and the *t* -tests were performed using the Statview 512^{TM}, The Interactive Statistics and Graphics Package, 1988. The two-way analysis of variance was performed using the CLR Anova 1.12 statistical package 1986.

4.1. One-way Anova/Cricket

This analysis was employed to test hypothesis 1, that there would be a significant difference in batting average between low, medium and high trait anxiety cricketers. It was anticipated that higher anxiety levels would result in a narrower focus of attention and because of the narrow attentional demands made on cricket batters it was predicted that the medium and high trait anxiety cricketers' batting average would be better than low trait anxiety cricketers.

This hypothesis, however, was not supported, $F\,(2,\ 57) = 3.015$, *n.s.* The scores were however in the predicted direction and were approaching significance (see Table 2 and 3 and Figure 1).

FIGURE 1

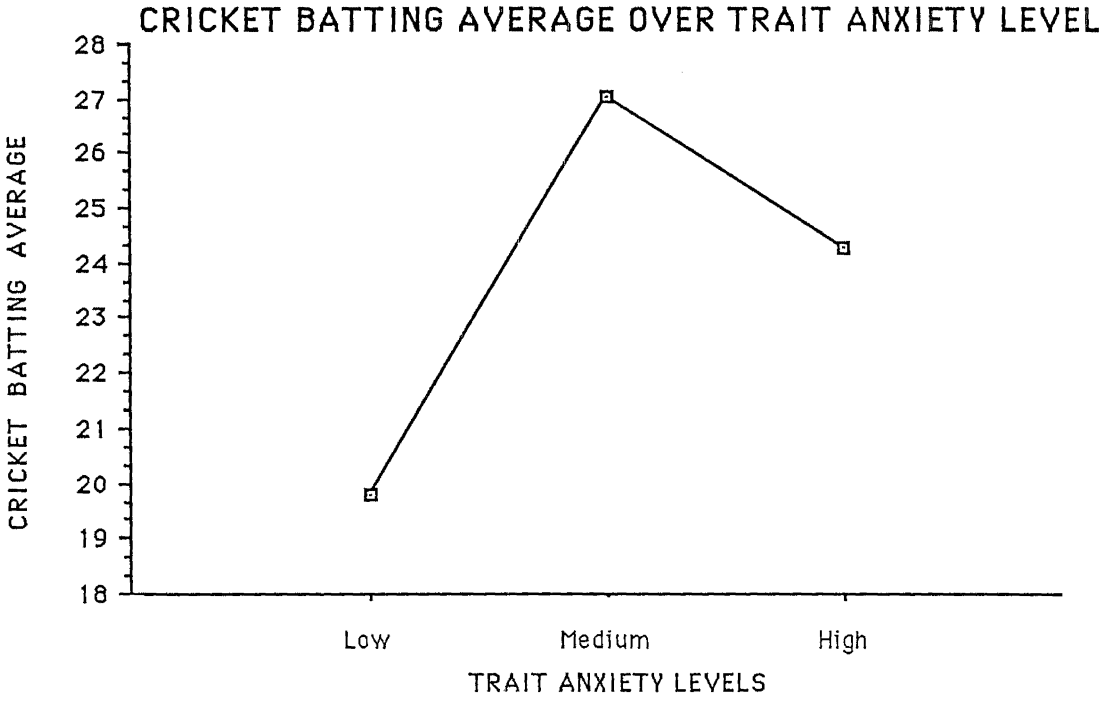

CRICKET BATTING AVERAGE OVER TRAIT ANXIETY LEVEL
CRICKET BATTING AVERAGE
28
27
26
25
24
23
22
21
20
19
18
Low
Medium
High
TRAIT ANXIETY LEVELS

Table 2. **Summary of one-way Anova of the effects of trait anxiety on batting average.**

Source	df	Sum Squares	Mean Square	*F* - Test
Between Groups	2	535.833	267.917	3.015
Within Group	57	5064.35	88.848	p =.0569
Total	59	5600.183		

Table 3. Summary of batting averages for the three trait anxiety levels.

Trait Anxiety Level	Batting Average
Low	19.8
Medium	27.05
High	24.3

4.2. One-way Anova/Soccer

This analysis was employed to test hypothesis 2, that there would be a significant difference in performance between low, medium and high trait anxiety soccer players. It was anticipated that higher anxiety levels would result in a narrower focus of attention and because of the broad attentional demands made on soccer players, it was predicted that medium and high trait anxiety soccer players' performance would be lower than low trait anxiety soccer players.

This hypothesis was supported, $F(2, 57) = 4.586$, $p < .05$ (see Tables 4 and 5 and Figure 2).

FIGURE 2

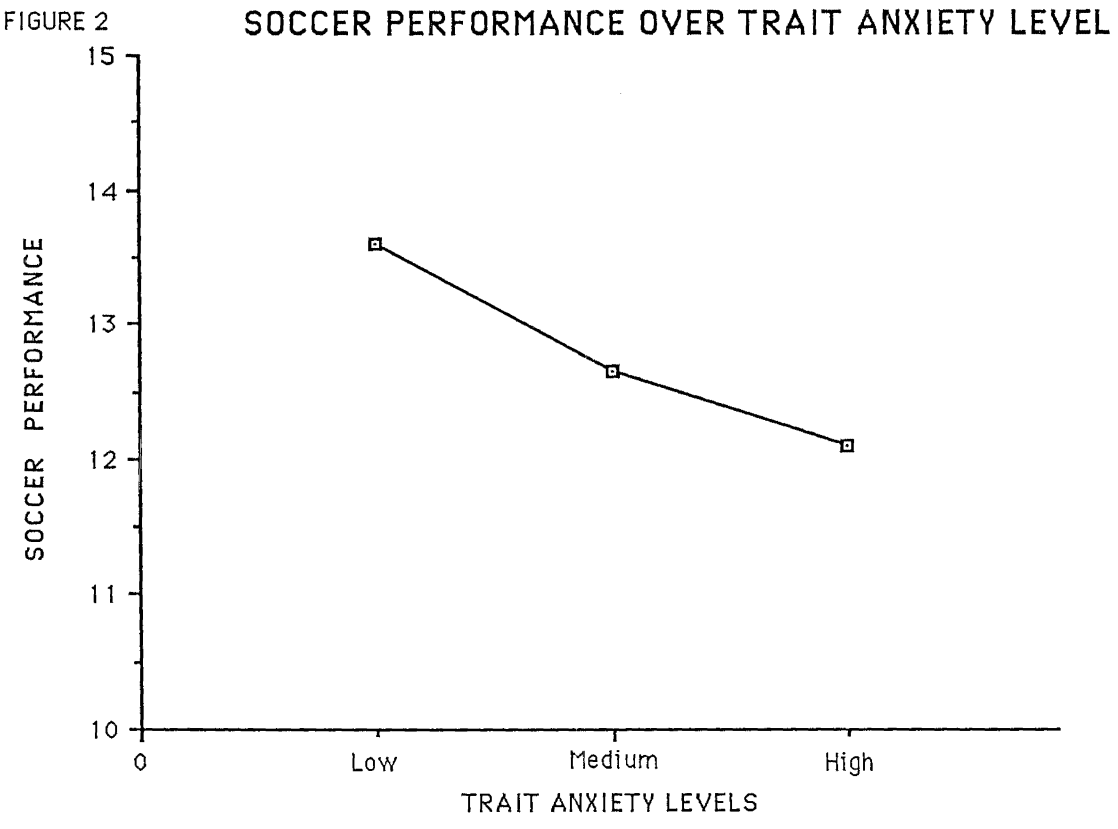

SOCCER PERFORMANCE OVER TRAIT ANXIETY LEVEL
SOCCER PERFORMANCE
15
14
13
12
11
10
0
Low
Medium
High
TRAIT ANXIETY LEVELS

Table 4. **Summary of one-way Anova of the effects of trait anxiety on soccer performance**

Source	df	Sum Squares	Mean Squares	F - test
Between Groups	2	23.033	11.517	4.586
Within Groups	57	143.15	2.511	p = .0142
Total	59	166.183		

Table 5. **Summary of soccer performance averages for the three trait anxiety levels.**

Trait Anxiety Level	Soccer Performance Average
low	13.6
medium	12.65
high	12.1

4.3. T - Tests/Soccer Data

Further analyses of the results revealed that there was a significant performance difference between the low and medium trait anxiety groups, t (38) = 1.84, p < .025, and between the low and high trait anxiety groups, t (38) = 3.298, p < .005, but no performance difference was found between the medium and high trait anxiety subjects, t (38) = 1.04, *n.s* . (see Table 6).

Table 6. **Summary of t-tests of the effects of trait anxiety on soccer performance.**

Trait Anxiety Groups	df	*t*	Sign
low versus medium	38	1.84	< .025
medium versus high	38	1.04	n.s.
low versus high	38	3.298	< .005

4.4. Putting Data: Two-Way Anova

This analysis was employed to test hypothesis 3, that there would be a significant difference in the putting performance of low, medium and high trait anxiety subjects under low and high state anxiety conditions.. Specifically it was anticipated that increased state anxiety will lead to improvements in putting performance of medium and high trait anxiety individuals.

This hypothesis was supported for trait anxiety effect, F (2, 57) = 3.475, p < .05, and state anxiety, F (1,57) = 16.132, p < .01. There was no interaction effect F (2, 57) = 2.207, *n.s.* (see Tables 7 and 8 and figure 3).

FIGURE 3

MEANS OF PUTTING PERFORMANCE OVER TRAIT AND STATE ANXIETY LEVELS

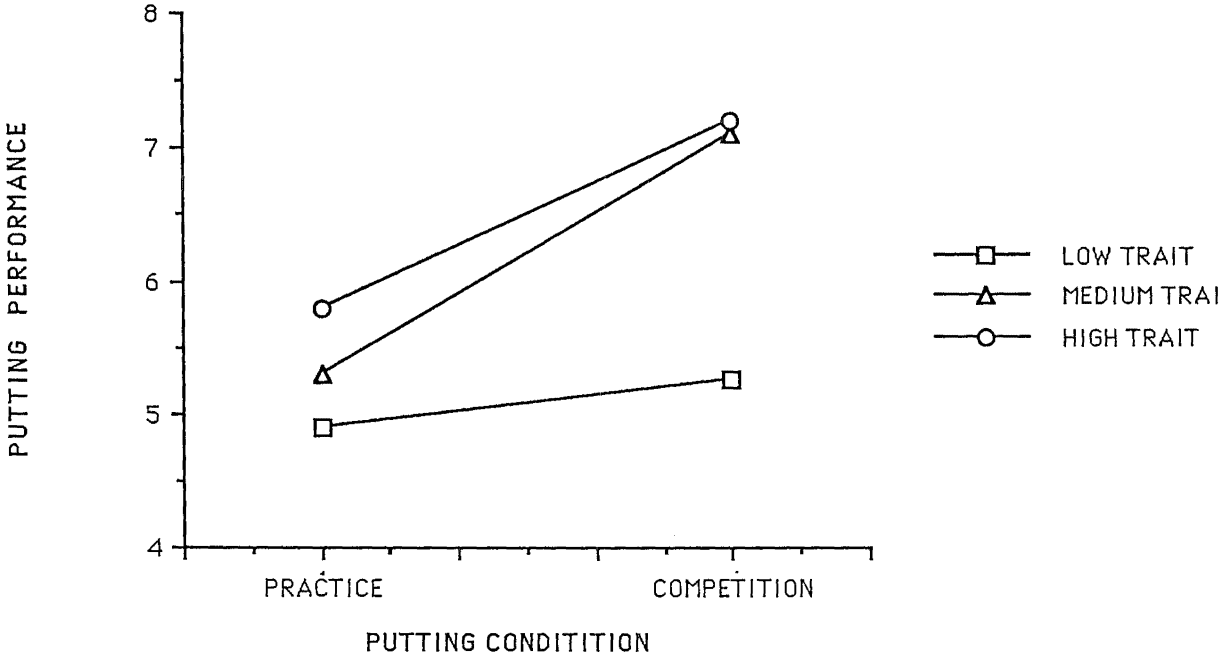


Table 7. Summary of two way Anova of the effects of trait and state anxiety on putting performance.

Source of variation	df	Sum of Squares	Mean Square	*F*	*p*
Trait	2	38.850	19.425	3.473	.0377
Error	57	318.775	5.593		
State	1	49.408	49.408	16.132	.0002
Trait/State	2	13.517	6.758	2.207	.1194
Error	57	174.575	3.008		

Table 8. Table of means of putting performance over trait and state anxiety levels.

Trait Anxiety Level	Low State Anxiety Putting Performance	High State Anxiety Putting Performance
low	4.9	5.25
medium	5.3	7.1
high	5.8	7.2

4.5. *T* - Tests: Putting Experiment

The next analysis consisted of *t* -tests investigating which trait anxiety levels yielded significant differences in practice and competition putting scores. The *t* -tests revealed that there was a significant performance difference between the practice and competition scores in the medium trait anxiety group, $t\ (38) = -2.743$, $p < .01$, the high trait anxiety group, $t\ (38) =$

-2.66, $p < .01$, but not in the low trait anxiety group, t (38) = -518, *n.s.* (see table 9).

Table 9. **Summary of t-tests on the effect of trait and state anxiety on putting performance in practice and competition.**

Trait Anxiety Group	Practice Putting Mean	Competition Putting Mean	t	Signif.
low	4.9	5.25	.518	n.s.
medium	5.3	7.1	2.743	<.01
low	5.8	7.2	2.66	<.01

4.6. *T*-tests: Putting Experiment

T -tests were also performed on the putting data to investigate the specific differences between the trait anxiety levels and the scores recorded within practice and within competition putting. The t -tests revealed that there was a significant putting performance difference between the competition scores of low versus medium trait anxiety subjects, t (38) = -2.43 $p < .025$ and low versus high trait anxiety subjects, t (38) = -2.743, $p < .01$, but not between medium and high trait anxiety subjects, t (38) = 0, *n.s.*

No significant differences were found between the practice scores of low versus medium trait anxiety subjects, t (38) = -.614, *n.s.* , low versus high trait anxiety subjects, t (38) = -1.117, *n.s.* , and medium versus high trait anxiety subjects, t (38) = -.508, *n.s.* (see Table 10).

Table 10. **Summary of t-tests on the effect of trait and state anxiety on putting in practice and competition.**

Task	Trait Anxiety Group	df	*t*	Significance
	low vs medium	38	-2.43	<.025
Competition	medium vs high	38	0	n.s.
Putting	low vs high	38	-2.743	<.01
	low vs medium	38	-.614	*n.s.*
Practice.	medium vs high	38	-.508	*n.s.*
Putting	low vs high	38	-1.117	*n.s.*

4.7. Manipulation Check 1

To check that the manipulated anxiety had actually caused an increase in state anxiety *t* -tests were carried out to look for differences within each trait anxiety level for increases in state anxiety from practice to competition.

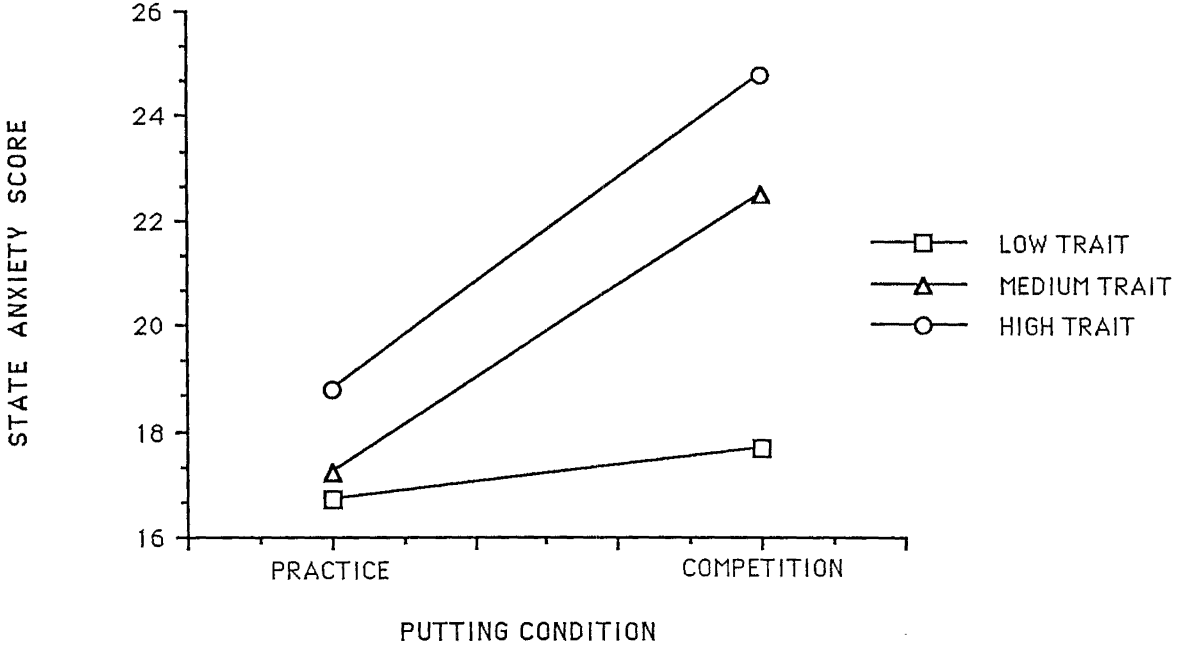
The manipulation appears to have been effective as the results showed a significant increase in anxiety in the medium trait anxiety group, t (38) = -3.103, $p < .005$, the high trait anxiety group t (38) = -3.868, $p < .005$. The low trait anxiety group showed an increase but was not significant, t (38) = -.697, *n.s.* (see Table 11 and Figure 4).

Table 11. Summary of t -tests showing increases in state anxiety in trait anxiety groups from practice to competition.

Trait Anxiety Group	df	*t*	Significance
low	38	-.697	*n.s.*
medium	38	-3.103	< .005
high	38	-3.868	< .005

FIGURE 4

CSAI SCORES OVER TRAIT ANXIETY AND PRACTICE AND COMPETITION PUTTING



4.8. Manipulation Check 2

The final manipulation check involved investigating the success of the Sport Competition Anxiety Test (SCAT) in predicting state anxiety reactions. The SCAT is supposed to identify individuals who vary in trait anxiety and hence vary in the levels of state anxiety produced in competitive situations. This analysis tested the ability of the SCAT to do this.

T -tests showed significant differences in competition CSAI scores between low versus medium trait anxiety subjects, t (38) = -3.3, $p < .005$, and low versus high trait anxiety subjects, t (38) = -4.473, $p < .005$. There was no significant difference between medium and high trait anxiety subjects t (38) = -1.482, *n.s* ., but the means were in the right direction.

T -tests showed no significant differences in practice CSAI scores between low versus medium trait anxiety subjects, t (38) = -.955, *n.s.* , low versus high trait anxiety subjects, t (38) = -1.508, *n.s.* , and medium versus high trait anxiety subjects, t (38) = -535, *n.s.* The means, however, were in the expected direction (see Tables 12 and 13 and Figure 4).

Table 12. Summary of means of CSAI scores in trait anxiety level and practice and competition putting.

Trait Anxiety Group	CSAI Score Practice Putting	CSAI Score Practice Putting
low	16.7	17.7
medium	17.2	22.5
high	18.9	24.8

Table 13. **Summary of t -tests showing state anxiety scores in relation to trait anxiety level.**

Trait Anxiety Group	df	*t*	Significance
Competition Putting			
low versus medium	38	-3.3	< .005
low versus high	38	-4.473	< .005
medium versus high	38	-1.482	*n.s.*
Practice Putting			
low versus medium	38	-.955	*n.s.*
low versus high	38	-1.508	*n.s.*
medium versus high	38	-.535	*n.s.*